

24. (a) KOH is a strong base so $[KOH] = [OH^-]$

$$[OH^-] = [KOH] = \frac{0.345g \text{ KOH}}{57.2 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ mole}}{56g} = 0.1075 \text{ M}$$

$$[H_3O^+] = \frac{K_w}{[OH^-]} = \frac{1.0 \times 10^{-14}}{0.1075} = 9.30 \times 10^{-14} \text{ M}$$

$$pH = -\log [H_3O^+] = -\log (9.30 \times 10^{-14}) = 13.03 \text{ basic}$$

(b) HCl is a strong acid

$$[H^+] = [HCl] = \frac{0.107 \text{ mole HCl}}{0.948 \text{ L}} \approx 0.119 \text{ M}$$

$$pH = -\log [H_3O^+] = -\log (0.119) = 0.924 \text{ acidic}$$

$$pOH = 14 - 0.924 = 13.076$$

$$[OH^-] = \frac{K_w}{[H_3O^+]} = \frac{1 \times 10^{-14}}{0.119} = 8.4 \times 10^{-14} \text{ M}$$

(c) KCl is a salt of conjugate acid and base of a strong base & strong acid. They will have no effect on pH, so $pH = 7$, $pOH = 7$ and $[H^+] = [OH^-] = 10^{-7}$ (neutral)

(d) HBr is a strong acid

$$[H^+] = [HBr] = \frac{0.000100 \text{ mole}}{100.0 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 1.00 \times 10^{-3} \text{ M}$$

$$pH = -\log [H^+] = -\log (1.00 \times 10^{-3}) = 3.000 \text{ acidic}$$

$$pOH = 14 - 3 = 11 \quad [OH^-] = 10^{-11} \text{ M}$$